
Labeling human embryonic stem cell-derived cardiomyocytes with indocyanine green for noninvasive tracking with optical imaging: an FDA-compatible alternative to firefly luciferase.

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Public Summary:

Scientific Abstract:

Human embryonic stem cell-derived cardiomyocytes (hESC-CMs) have demonstrated the ability to improve myocardial function following transplantation into an ischemic heart; however, the functional benefits are transient possibly due to poor cell retention. A diagnostic technique that could visualize transplanted hESC-CMs could help to optimize stem cell delivery techniques. Thus, the purpose of this study was to develop a labeling technique for hESCs and hESC-CMs with the FDA-approved contrast agent indocyanine green (ICG) for optical imaging (OI). hESCs were labeled with 0.5, 1.0, 2.0, and 2.5 mg/ml of ICG for 30, 45, and 60 min at 37 degrees C. Longitudinal OI studies were performed with both hESCs and hESC-CMs. The expression of surface proteins was assessed with immunofluorescent staining. hESCs labeled with 2 mg ICG/ml for 60 min achieved maximum fluorescence. Longitudinal studies revealed that the fluorescent signal was equivalent to controls at 120 h postlabeling. The fluorescence signal of hESCs and hESC-CMs at 1, 24, and 48 h was significantly higher compared to precontrast data ($p < 0.05$). Immunocytochemistry revealed retention of cell-specific surface and nuclear markers postlabeling. These data demonstrate that hESCs and hESC-CMs labeled with ICG show a significant fluorescence up to 48 h and can be visualized with OI. The labeling procedure does not impair the viability or functional integrity of the cells. The technique may be useful for assessing different delivery routes in order to improve the engraftment of transplanted hESC-CMs or other stem cell progenitors.

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